RISKSize Service

Extended Mode - Methodology

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Contents

Introduction

The aim of this document is to illustrate the content of RISKSize – Extended Mode. In particular, the next sections present a number of methodological aspects that differ according to various types of financial instruments. Input and output files are accurately described as well.

Chapter 1

Stocks mapping in RISKSize - Extended Mode

Before estimating volatility it is necessary to associate the stock with an appropriate risk factor present in the RISKSize matrix and to determine the beta coefficient linking the volatility of the stock returns to the volatility of the selected risk factor returns.

1.1 Determination of an appropriate risk factor

A careful risk factor selection is extremely important for an accurate volatility estimation. The methodology adopted by Prometeia consists in analyzing the following information:

- industrial sector to which the issuing company belongs to (financial, utilities etc.)
- the country where the issuer is most active (ITL, USD, KRW etc.);
- primary exchange.

Once this information is determined it may happen that:

- in RISKSize there is a sector stock index corresponding to both the primary industry and to the country where the issuing company is most active. In this case the stock index found is associated to the stock considered (e.g. ENEL listed in Milano is associated to EUR.IUTILSIT, that is an Italian utilities index);
- in RISKSize there is an index corresponding to the country but not to the industry. In this case the stock is associated to the general country index (e.g. USD.SE for an US stock);

- in RISKSize there is no data with respect to the country where the issuer is most active but there is data regarding a country characterized by a significant similarity in economic and financial terms to the country of reference (e.g. a Dutch issuer belonging to financial sector is associated to EUR.ITOTLFBD that is to a German financials index);
- in RISKSize there is no indication of the country of reference but it is possible to find an appropriate sector index relative to the primary exchange where the stock was listed. This index is used as a risk factor for such a stock;
- the primary industry of the issuer is considered by the RISKSize but the information regarding the country of reference and the primary stock exchange makes it impossible to associate the stock to a particular index. The solution adopted implies liking the stock to a US stock exchange index pertaining to the industry considered;
- the primary industry, the country of reference and the primary exchange are not available in RISKSize. In this case the risk factor associated is the general US stock exchange index (USD.SE).

1.2 Beta coefficient determination

In order to calculate the beta coefficient necessary to determine stock returns volatility, the following procedure is carried out:

- estimation of 120 daily returns volatility of the appropriate risk factor (based on its time series) is estimated using an exponentially weighted approach with a decay factor $\lambda = 0.94$;
- estimation of 120 daily returns volatility of the stock (based on total return time series including dividends) using the same methodology adopted while determining the risk factor volatility. If necessary the time series of the stock is converted into the same currency of the risk factor in order to guarantee the consistency of the respective time series;
- determination of first stage structural beta coefficient aimed at a prudent evaluation of the stock riskiness by using the ratio between the estimated stock returns volatility and the appropriate risk factor volatility;
- beta coefficient delivered as output is a function of the value found in the previous step and may differ from it if estimate likelihood controls require a number of corrections depending on the presence of incomplete databases.

Finally, stock returns volatility is a function of the product of the relative risk factor volatility and the beta coefficient delivered in output.

Chapter 2

Funds mapping in RISKSize - Extended Mode

As in the case of stocks, funds riskiness is estimated through an association of each fund to an appropriate risk factor present in the RISKSize matrix and a parallel estimation of the beta coefficient (systematic risk) as well as the residual volatility determination (idiosyncratic risk). Estimation methodology differs the one used for stocks in order to account for the different characteristics of the two types of financial instruments.

2.1 Appropriate risk factor determination

Association of a fund to an appropriate risk factor is carried out according to an in-house methodology that combines quantitative information derived from the time series analysis with a number of qualitative aspects such as fund's type and description, benchmark of reference, some additional information revealed by the management with respect to the composition of the fund's assets, etc.

Quantitative information is obtained first of all by regressing historical returns of the fund with respect to the entire range of risk factors identifying in such a way those risk factors whose descriptive statistics are better.

Besides, quantitative information are also based on the results of the levels cointegration analysis able to point out the risk factor better representing the long time performance of the fund.

An additional qualitative analysis is carried out based on the data revealed by the fund in order to choose an optimal benchmark. Quantitative approach together with a comparison of estimates over all the risk factors solve every problem related to incom-

pleteness of the fund data. Moreover, this strategy makes it possible to associate an appropriate risk factor to each fund independently from the asset allocation and stock picking strategies as well as from the timing ability of the manager. The wide variety of risk factors available as well as their ongoing monitoring and updating produce significant and highly informative estimates even for non-traditional funds in terms of industry of reference and financial instruments choice.

2.2 Beta coefficient calculation and volatility estimation

The model underlying all the regressions is a single factor model. The time series considered are NAV series adjusted for dividends and denominated in Euro. The model equation is the following:

$$y_t = \alpha + \beta \times x_t + \epsilon_t$$

where y_t is the return of the fund, x_t is the return of the benchmark, α and β are estimated coefficients, ϵ_t is the residual of the regression.

In order to find an appropriate index for beta estimation a number of single factor regressions is run on different indices. Beta coefficient is then estimated using the least squares approach based on one year of both daily and weekly data The raw beta is determined after a subsequent quantitative and qualitative analysis aiming at identification of a correct risk factor.

The determination of beta consists of two phases. The first one aims at identifying the most appropriate benchmark index among those present in the matrix. During the first stage a single factor regression is carried out for each benchmark index providing the descriptive statistics that are subsequently compared taking also into consideration the basic features of the fund. During the second stage the raw beta is estimated using as regressor the risk factor chosen at the first stage.The raw beta may be influenced by a number of possible final corrections when some basic information of the fund is missing or in case the fund has an atypical investment strategy. The residual volatility is estimated on a period of 120 calendar days using exponentially weighted approach with a decay factor $\lambda = 0.94$ and is updated and distributed simultaneously with the beta.

Chapter 3

Hedge Funds mapping in RISKSize - Extended Mode

For hedge funds and funds of hedge funds, the riskiness is estimated through an attribution of a fund to a set of hedge fund indices present in the RISKSise matrix. The indices selected are characteristic of the different management strategies. At the same time, beta and the residual volatility are estimated.

Multi-factor regression is used to select the most significant risk factors.First of all, it is necessary to define a general model whose regressors are represented by 10 hedge fund indices characteristic of the main ten pure strategies of management. The procedure is described by the following steps:

- general model is estimated by means of OLS method;
- for each significant variable t-statistic and the relative p-value are calculated;
- non-significant regressors are identified and eliminated;
- the least significant regressor is eliminated reducing by one the number of factors;
- OLS betas of the 9-factor model are estimated and all the steps above are repeated until all the explanatory variables become significant.

The previous phase is called *stepwise regression*. Once the final set of regressors has been determined WLS (Weighted Least Squares) betas and residual volatility are estimated. Such an estimation method is implements a diagonal weighting matrix containing the weights consistent with the exponential weighting. Decay factor is the same used for the risk factors matrix. Since hedge funds and funds of hedge funds provide data mostly with a monthly frequency, the decay factor has been decided to be equal to

0.8 [1]. Residual volatility is also calculated using exponentially weighting approach and is transformed into daily volatility through a square root of time.

[1]See the document RISKSize Service - Basic Mode for further information on the choice of the appropriate decay factor for the monthly coverage ratios.

Chapter 4

Covered Warrant mapping in RISKSize - Extended Mode

For covered warrants the output contains the structural beta and the the residual volatility relative to the underlying stock price. Determination of such values is described in the paragraph 6.2.2.

Chapter 5

Estimates Revision

New estimates for betas and residual volatilities for stocks, funds and covered warrants are produced with a frequency of 15 years. However risk factors revision for all the funds is carried out at least quarterly in order to account for the changes in the investment policy of the fund (e.g. flexible funds) and to be able to find the most suitable benchmark. Finally, for hedge funds and funds of hedge funds the statistics are updated every month consistently with the respective data frequency.

Chapter 6

Input and Output files

Extended mode query occurs when a request file (.csv format) is sent through the website http://www.risksize.com. That file contains a list of securities when the key is ISIN. As soon as the request file is processed the reply file is generated (even .csv format).The following table lists codes to use for each type of financial instrument while forwarding requests.

Security Code	Security type
78	Stocks
80	Covered Warrant
81/82	Funds
150	Bonds

Table 6.1: Securities econding

In the next paragraphs follows an accurate description of output files divided by instrument type.

6.1 Request file

Extended mode query occurs when a request file is sent to the website http://www.risksize.com having a .csv format. It contains a list of securities to elaborate. The following table lists the fields of the request files.

Variable	Description	Mandatory
SECURITY_TYPE	Security type code according to the scheme of the table 6.1	YES
COD_ISIN	Isin code of financial instrument	YES
COD_ISIN_SOTT	Isin code of underlying. Mandatory only for the type 80	NO

Table 6.2: Request file

6.2 Output file

Output files have .csv format and depend on the type of the security considered. Their fields are separated by the mark ";".

6.2.1 Stocks (type 78)

The following table lists the fields included in the output file for stocks (type 78).

Variable	Description	Type
SECURITY_TYPE	Security type code according to the scheme of the table 6.1. For stocks it is equal to 78	Int
COD_ISIN	Isin code of financial instrument	Char
COD_FDR	RISKSize code of the risk factor for sector index	Char
BETA	Structural beta value for sector index.	Float
COE_R1	Residuals volatilità of the OLS regression with the respect to the stock Exchange index of reference	Float
BETA2	OLS beta value of the regression with respect to the stock Exchange index of reference	Float
COD_DIV1	Currency code of the exchange market	Char
COD_DIV2	Currency code of the country of issue	Char

Table 6.3: Output file for stocks

6.2.2 Covered Warrants (type 80)

The following table lists the fields included in the output file for covered warrants (type of Securities 80).

Variable	Description	Type
SECURITY_TYPE	Security type code according to the scheme of the table 6.1. For covered warrants it is equal to 80	Int
COD_ISIN	Isin code of financial instrument	Char
COD_ISIN_SOTT	Isin code of underlying	Char
COD_FDR	RISKSize code of the risk factor for sector index	Char
BETA	Structural beta value for sector index	Float
BETA_SOTT	OLS beta value of the regression with respect to the stock exchange index of reference	Float
COE_R1	Residuals volatility of the OLS regression with respect to the stock exchange index of reference	Float
COD_DIV1	Currency code of the market of floatation	Char
COD_DIV2	Currency code of the country of the issuer	Char

Table 6.4: Output file for covered warrants

6.2.3 Funds (type 81 / 82)

The following table lists the fields included in the output file for the funds (type of security 81 / 82). If the requests specifies the security type 81, the output file is going to contain the security type 82 and systemic and idiosyncratic risk of the fund are indicated separately.

Variable	Description	Type
SECURITY_TYPE	Security type code according to the scheme of the table 6.1. For funds it is equal to 82.	Int
COD_ISIN	Isin code of financial instrument	Char
COD_FDR	RISKSize code of the risk factor	Char
BETA	OLS beta value of the regression with respect to the stock Exchange index of reference	Float
VOL_RES	Residual volatility of the OLS regression with respect to the stock Exchange index of reference	Float
TIPO_FDR	Risk factor type. May take on the following values: “S” – specific risk, “I” – interest rate risk, “A” or “B”– stock price risk, “V” – specific risk	Char

Table 6.5: Output file for funds